Part 3 -- Remarks

This Amendment and Response is responsive to the office action mailed November 20, 2002. In that office action, claims 3-7 were objected to because of an informality; claims 1-2 and 8-10 were rejected under 35 U.S.C. 102(b) as anticipated by Stover et al. (U.S. Patent 3,914,708); and claims 3-7 were rejected under 35 U.S.C. 103(a) as being unpatentable over Stover et al. in view of Sze.

Reconsideration of these objections and rejections is respectfully requested, with respect to the pending claims 1-10.

Claim Objection

Claim 3, line 3 has been amended to replace N=Bxm with N=Bxexp(m) so that the equation conforms with specification.

Anticipated Rejection

Reconsideration of the rejections of claims 1-2 and 8-10 under 35 USC 102(b) as being anticipated by Stover (3,914,708) is respectfully requested.

Regarding claims 1 and 2, the dopant concentration in Stover, is increased non-linearly through the first region 31 (see Figure 3) to a maximum at a certain depth shown by point 34. Then the concentration is decreased through second region 36 to a minimum concentration at point 40. Stover teaches that the linear of the capacitance/voltage curve in figure 4b (steep slope portion 58) results from the sharply decreasing impurity concentration in region 36, not the increasing impurity concentration in region 31. See column 7, lines 1-5. Figure 4a is an ideal representation of Figure 4b and the steep slope portion 50 corresponds to the steep slope portion 58 of Figure 4b as is pointed out in column 6, lines 7-8.

In contrast, claim 1 requires a non-uniform dopant concentration profile that increases, not decreases, with depth. It is this increasing non-uniform dopant profile that causes the varactor to have the approximate linear capacitance/voltage

response characteristic. The claimed increasing dopant concentration profile to obtain a linear response is directly in contrast with Stover's decreasing dopant profile to obtain a linear response. Accordingly, claim 1 calls for subject matter not described in Stover et al. It is respectfully submitted that claim 1 is not anticipated by Stover, and the rejection should be withdrawn. Since claim 2 depends from claim 1, and likewise calls for subject matter not described in Stover et al., withdrawal of the rejection of claim 2 is also requested.

Regarding claim 8, Stover teaches in figure 2a and the related text, a first side 12 formed relative to the semiconductor substrate and being doped with a first type of dopant profile, and a second side. It appears that the second side 26 is not formed in the semiconductor substrate 10 but instead is formed on the first side.

Also, Stover does not appear to create a capacitance between the first side and the second side that is linearly variable with the voltage bias. Comparing Figures 4a and 4b, which show the capacitance to voltage relationship in Stover, with the capacitance to voltage relationship recited in claim 8, as exemplified by Figure 5 in the present application, the differences between Stover and claim 8 become more apparent. Claim 8 describes the capacitance between the first side and the second side as linearly variable with the voltage bias. The relationship of capacitance to voltage in Stover appears decidedly non-linear, having the double curve reversed "S" type shape shown in Fig. 4b. Stover relies on this non-linearity, seeking to establish the ideal bi-state varactor of his figure 4a with a first high capacitance state 52 and a low capacitance state 54. Stover compares this with the obtained non-linearity shown in figure 4b to the ideal bi-state varactor as indicated in column 6, lines 7-8. It therefore appears that Stover's purpose and structure are completely different. Stover seeks non-linearity to establish two distinct capacitive states while claim 8 relates to a linearly variable capacitance whose values change linearly in relation to the applied bias voltage. For these

and other reasons, claim 8 is distinguishable from Stover et al. Withdrawal of the anticipated rejection is respectfully requested.

Claim 9 should be allowable in conjunction with claim 8 and because it claims an increasing dopant concentration with increasing depth from the second side to a peak concentration region, and because the peak concentration region functions as a conductive path to and from the varactor. The peak dopant concentration in the present invention attains a singular peak as distinguished from Stover which has two peak dopant concentration levels. Claim 10 should be patentable in conjunction with claim 8.

Obviousness Rejections

Reconsideration of the obviousness rejections of claims 3-7 in view of Stover et al. and Sze is respectfully requested.

Claims 3-5 describe, in the manner set forth, a linear capacitance/voltage response curve, Stover describes at column 5, lines 59-62 the importance of a distribution of charge carriers in the impurity profile as directly contributing to the bi-state switching operation, as shown in Figure 4a. The dopant density profile used by Stover to create the bi-state varactor has an almost sine wave type shape (see Figure 3), and such a shape is certainly not the shape created by the equation N=Bxexp(m) of claim 3 and shown in figure 3. Indeed, the only part of the capacitance/voltage response curve in Stover that has any linearity, (see figure 4b) is between deflection point 35 and capacitance plateau 62, but this linearity is created by the decreasing the dopant density, not an increasing density as recited in claim 3. This decreasing dopant density with depth, which obtains linearity, appears to be the opposite of increasing the dopant density with depth to obtain linearity as recited in claim 3. Accordingly, there is no suggestion or motivation in Stover to combine the Sze equation N=Bxexp(m) for an exponentially

increasing dopant density with depth, in preference for the decreasing dopant density profile of Stover et al.

Regarding claims 6-7, both claims specify that m is greater than zero. By claiming m greater than zero, the dopant density increases with depth to cause the linear capacitance to voltage curve, which distinguishes from Stover and Sze as discussed above.

For the reasons stated above, and others, claims 3-7 are not believed to be obvious or properly rejectable based on Stover and Sze.

Conclusion

For the reasons specifically discussed above, and others, it is believed that pending claims 1-10 define patentable subject matter. Reconsideration of the previous rejections as they might apply to the pending claims is therefore respectfully requested. The Examiner is requested to telephone the undersigned to resolve any remaining issues which inhibit the immediate allowance of the application.

Respectfully submitted,

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